SEU/SEL Resistant Ultra-Low Power Asynchronous Processor Design for Low-Temperature Applications, Phase I

Completed Technology Project (2009 - 2009)

Project Introduction

This Phase I SBIR proposal seeks funding to develop a radiation-hardened circuit architecture to achieve SEU and SEL immunity by using delay-insensitive asynchronous logic, and to demonstrate its feasibility, effectiveness, and efficiency. Further, early studies reveal that an operational temperature range of 2K to 400K will be highly feasible. Delay-insensitive asynchronous logic removes the concept of a global clock by incorporating handshaking protocols to control the circuit. The handshaking protocols allows for flexible timing requirements, high power efficiency, and low noise/emission generation. The flexible timing nature of delay-insensitive logic makes this type of circuits an excellent candidate for mitigating radiation effects in digital electronics. Compared to the existing radiation-hardening techniques, the proposed solution has several substantial benefits including cost efficiency, SEU/SEL immunity without weak points, and the ability to retain data during power cycling while mitigating SEL. In addition, significantly improved supply voltage variation sustainability and security against power-based side-channel attacks can also be achieved.

Primary U.S. Work Locations and Key Partners

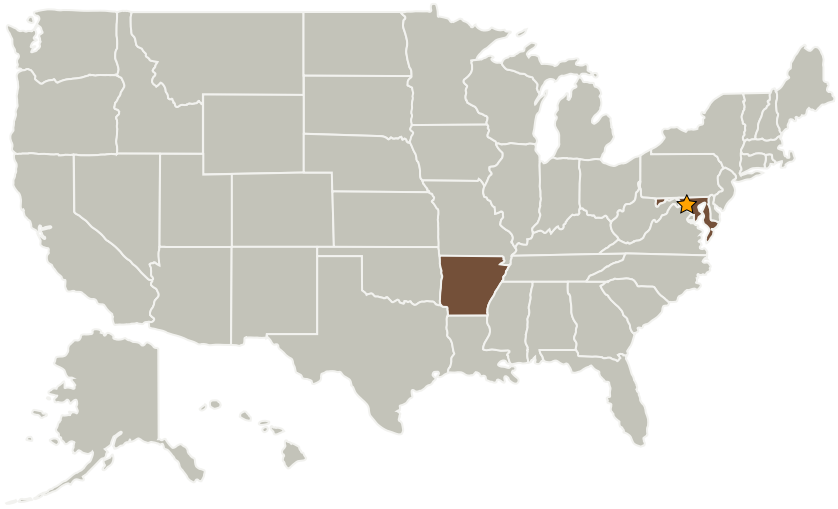

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Table of Contents

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Goddard Space Flight Center (GSFC)

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

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Organizations Performing Work	Role	Type	Location
★Goddard Space Flight Center(GSFC)	Lead Organization	NASA Center	Greenbelt, Maryland
Space Photonics, Inc.	Supporting Organization	Industry	Fayetteville, Arkansas

Primary U.S. Work Locations	
Arkansas	Maryland

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Technology Areas

Primary:

- TX02 Flight Computing and Avionics
  - TX02.1 Avionics Component Technologies
    - TX02.1.6 Radiation Hardened ASIC Technologies